

# MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology  
Standard Reference Materials Program  
Bldg. 202 Rm. 211  
Gaithersburg, Maryland 20899

SRM Number: 3108  
MSDS Number: 3108  
SRM Name: Cadmium Standard Solution  
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## SECTION I. MATERIAL IDENTIFICATION

**Material Name:** Cadmium Standard Solution

**Description:** SRM 3108 is a single element solution prepared gravimetrically to contain an approximate 9 mg/g of cadmium with a nitric acid volume fraction of 10 %.

**Other Designations:** Cadmium in Nitric Acid (aqua fortis; hydrogen nitrate; azotic acid; engravers acid). Cadmium Nitrate\* (cadmium dinitrate; nitric acid cadmium salt) in Spectrometric Standard Solution.

Name	Chemical Formulas	CAS Registration Numbers
Nitric Acid	HNO <sub>3</sub>	7697-37-2
Cadmium Nitrate	Cd(NO <sub>3</sub> ) <sub>2</sub>	10325-94-7
Cadmium	Cd	7440-43-9

**DOT Classification:** Nitric Acid Solution, UN2031

**Manufacturer/Supplier:** Available from a number of suppliers

\*The addition of cadmium to nitric acid, along with other intermediate chemical reactions, forms cadmium nitrate which will precipitate upon evaporation or drying of the solution.

## SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m <sup>3</sup>
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m <sup>3</sup>
		Human, Oral: LD <sub>LO</sub> : 430 mg/kg
Cadmium Nitrate	1.9	ACGIH TLV: 0.002 mg/m <sup>3</sup> (respirable particulate)
		OSHA TLV-TWA: 0.005 mg/m <sup>3</sup>
		Rat, Oral: LD <sub>50</sub> : 300 mg/kg
Cadmium	0.9	ACGIH TLV: 0.002 mg/m <sup>3</sup> (respirable particulate)
		OSHA TLV-TWA: 0.005 mg/m <sup>3</sup>
		Rat, Oral: TD <sub>LO</sub> : 155 mg/kg (13 weeks)

### SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Cadmium Nitrate	Cadmium
<b>Appearance and Odor:</b> A white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; an irritating odor.	<b>Appearance and Odor:</b> A solid, colorless or white, hygroscopic crystal with no odor.	<b>Appearance and Odor:</b> A solid, lustrous white powder.
<b>Relative Molecular Mass:</b> 63.02	<b>Relative Molecular Mass:</b> 236.42	<b>Relative Atomic Mass:</b> 112.41
<b>Density:</b> 1.0543 (10% nitric acid)	<b>Density:</b> N/A	<b>Density:</b> 8.642
<b>Solubility in Water:</b> Soluble	<b>Solubility in Water:</b> Soluble	<b>Solubility in Water:</b> Insoluble
<b>Solvent Solubility:</b> Decomposes in alcohol.	<b>Solvent Solubility:</b> Soluble in acids, ethyl acetate, ammonia, and alcohol.	<b>Solvent Solubility:</b> Soluble in acids, ammonium nitrate, hot sulfuric acid, and hydrochloric acid.

**Note:** The physical and chemical data provided are for pure compounds. Physical and chemical data for this cadmium/nitric acid solution do not exist. The actual behavior of this solution may differ from the individual components.

## SECTION IV. FIRE AND EXPLOSION HAZARD DATA

<b>Flash Point:</b>	N/A	<b>Method Used:</b>	N/A	<b>Autoignition Temperature:</b>	N/A
<b>Flammability Limits in Air (Volume %):</b>	<b>UPPER:</b>	N/A			
	<b>LOWER:</b>	N/A			

**Unusual Fire and Explosion Hazards:** Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Cadmium nitrate is a negligible fire hazard, but may ignite or explode when exposed to combustible materials. The sensitivity for explosion may increase with the presence of metal powders. Cadmium forms an explosive reaction with ammonium nitrate, hydrazoic acid, and strong oxidizers.

**Extinguishing Media:** Do not use dry chemicals, carbon dioxide, or halogenated extinguishing media because of cadmium nitrate. Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

**Special Fire Procedures:** Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

## SECTION V. REACTIVITY DATA

**Stability:**          X   Stable               Unstable

**Conditions to Avoid:** Avoid contact with combustible and other incompatible materials.

**Incompatibility (Materials to Avoid):** Keep nitric acid away from organic materials, plastics, rubber, and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide. Avoid metals, metal oxides, hydroxides, amines, carbonates, and other alkaline materials, cyanides, sulfides, sulfates, and formaldehyde. Cadmium nitrate is incompatible with combustible materials, metals, metal salts, reducing agents, and acids. Cadmium is incompatible with oxidizing materials, acids, and metals.

See Section IV: *Unusual Fire and Explosion Hazards*.

**Hazardous Decomposition or Byproducts:** Hazardous decomposition of nitric acid and/or cadmium nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), as well as nitric acid mist or vapor. Thermal

decomposition of cadmium may produce oxides of cadmium.

**Hazardous Polymerization:** \_\_\_\_\_ Will Occur   X   Will Not Occur

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## SECTION VI. HEALTH HAZARD DATA

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**Route of Entry:**   X   Inhalation   X   Skin   X   Ingestion

**Health Hazards (Acute and Chronic): Nitric Acid:** Nitric acid may be fatal if inhaled, swallowed, or absorbed through skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

**Cadmium Nitrate and Cadmium:** Cadmium nitrate and cadmium may be harmful by inhalation or ingestion. These materials may cause irritation to skin, eyes, mucous membranes, and upper respiratory tract. Cadmium and its compounds are highly cumulative and respiratory effects from repeated or prolonged exposure to dusts or fumes may include rhinitis, bronchitis, emphysema, cough, dyspnea, abnormal lung function, obstructive disease, and possible fibrosis. Ulceration of the nasal septum and yellow discoloration of the teeth may occur. Cadmium induced kidney damage is irreversible and may progress after exposure ceases. Occupational exposure to cadmium is implicated in a significant increase in the incidence of cancer of the lung and prostate.

**Signs and Symptoms of Exposure:** Irritation, difficulty breathing, burning sensation, and yellow skin discoloration can result from contact with nitric acid. Stomach pains, vomiting, and dizziness are connected with exposure to cadmium and cadmium compounds.

**Medical Conditions Generally Aggravated by Exposure:** Eye, skin, kidney and respiratory disorders and allergies

**Listed as a Carcinogen/Potential Carcinogen:**

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens*	<u>  X  </u>	_____
In the International Agency for Research on Cancer (IARC) Monographs**	<u>  X  </u>	_____
By the Occupational Safety and Health Administration (OSHA)	<u>  X  </u>	_____

\*The NTP classifies cadmium and its compounds as substances that are reasonably *Anticipated to be Human Carcinogens*.

\*\*The IARC classifies cadmium and its compounds as *Carcinogenic to Humans*.

## EMERGENCY AND FIRST AID PROCEDURES:

**Skin Contact:** Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

**Eye Contact:** Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

**Inhalation:** If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance.

**Ingestion:** If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance immediately.

**Note (Nitric Acid):** Wash affected skin areas with 5 % solution of sodium bicarbonate ( $\text{NaHCO}_3$ ). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. DO NOT give the exposed person bicarbonate to neutralize the material.

**TARGET ORGAN(S) OF ATTACK:**      **Nitric Acid:** Skin, teeth, eyes, and upper respiratory tract  
   **Cadmium and Cadmium Nitrate:** Kidneys and respiratory system

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## SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

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**Steps to be Taken in Case Material is Released or Spilled:** Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

**Waste Disposal:** Follow all federal, state, and local laws governing disposal.

**Handling and Storage:** Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas several times a day with soap and warm water.

Store under normal laboratory conditions in the original container.

**Note:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

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## SECTION VIII. SOURCE DATA/OTHER COMMENTS

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**Sources:** MDL Information Systems, Inc., MSDS *Cadmium*, December 8, 1998.  
MDL Information Systems, Inc., MSDS *Cadmium Nitrate*, December 8, 1998.  
MDL Information Systems, Inc., MSDS *Nitric Acid*, March 12, 1998.  
Substance Safety Data Sheet, *Cadmium*, 1910.1027 App A.  
<http://www.osha-slc.gov/oshasd-data/1910-1027-app-a.html>.  
Merck Index, 11th ed., 1989.  
The Sigma Aldrich Library of Chemical Safety Data, Ed. II, 1988.

**Disclaimer:** Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.